I. Aerosol Forcing to SW & LW at Surface & TOA in Clear Skies (April 1998)

with a slide of speculation

II. A Look at Total-sky Aerosol Forcing (17 June 1998)

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CERES Science Team Co-I Report (May 8, 2003 Norfolk, Virginia)

Search web for "CERES CAVE" to access group data,

point and click radiative transfer

SARB AOT alternately from VIRS (retrieval) or MATCH assimilation

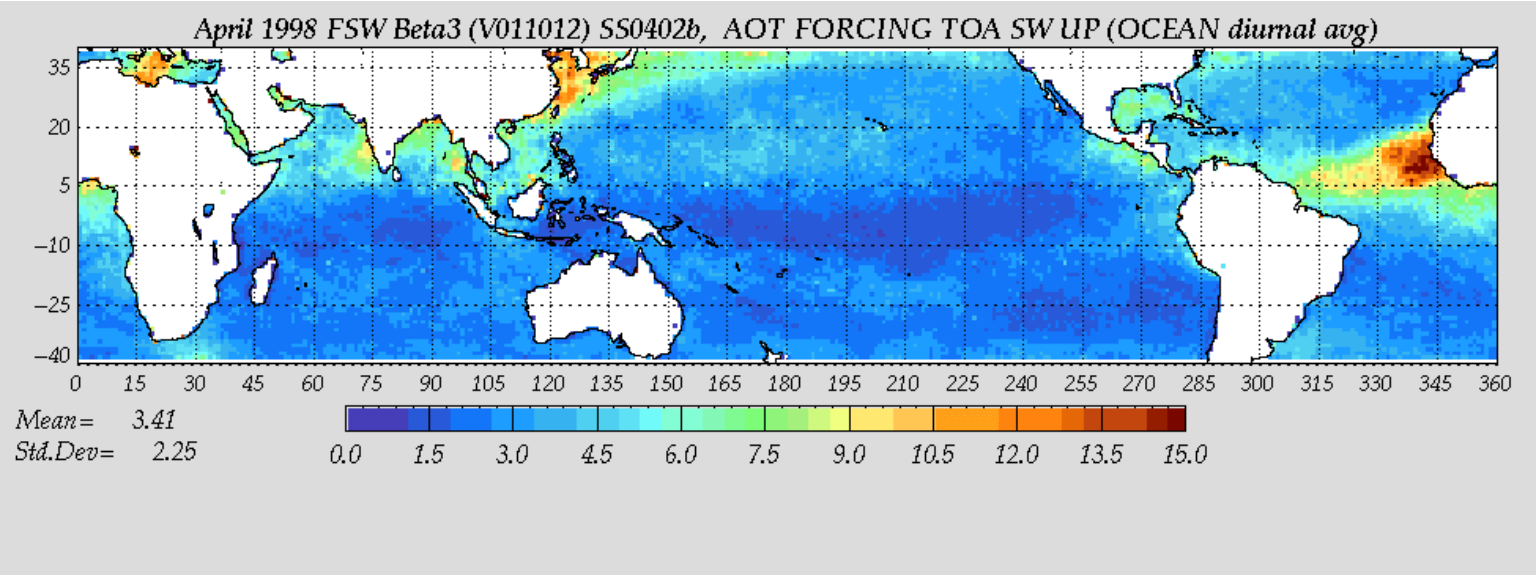
Has more absorption than found by Kaufman and Dubovik

Assignment of aerosol characteristics: Based on MATCH

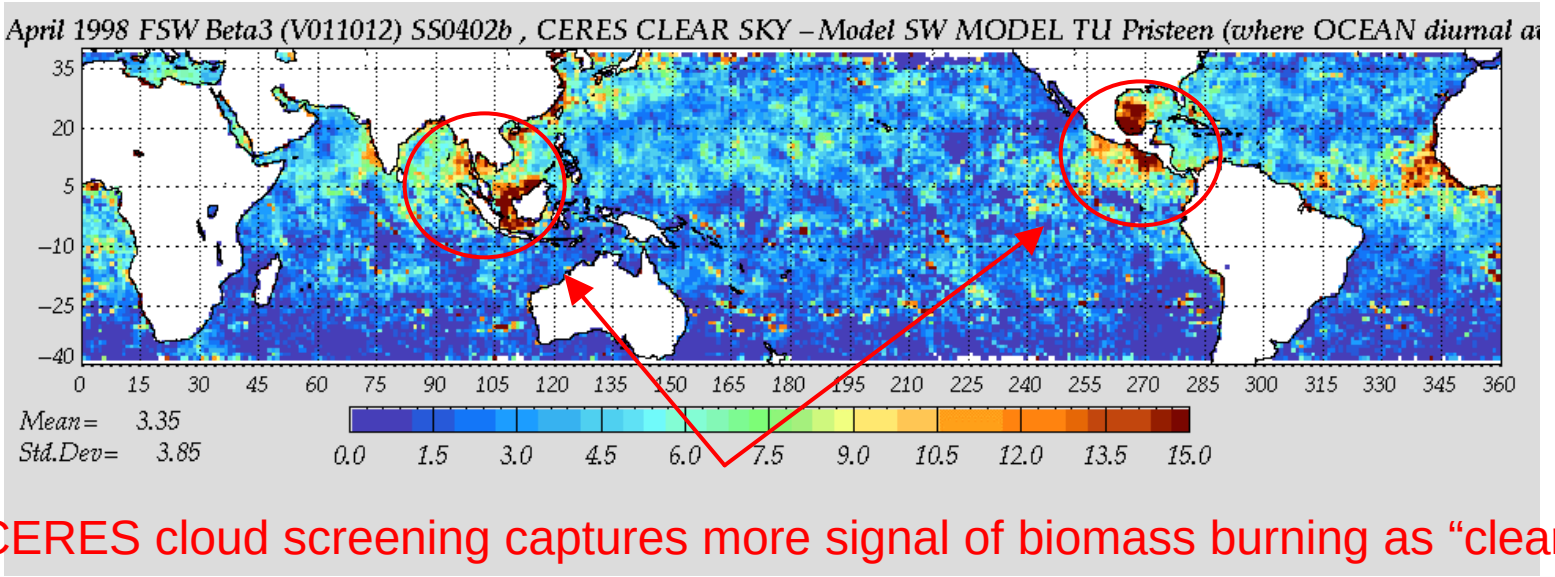
MATCH aerosol type	CRS aerosol optics	scale height
dust (0.01-1.0 um)	dust (0.5 um) Tegen-Lacis	3 km
dust (1-10 um)	dust (2.0 um) Tegen-Lacis	1 km
dust (10-20 um)	dust (2.0 um) Tegen-Lacis	1 km
dust (20-50 um)	dust (2.0 um) Tegen-Lacis	1 km
hydrophilic black carbon	soot (OPAC)	1 km
hydrophobic black carbon	soot (OPAC)	1 km
hydrophilic organic carbon	soluble organic (OPAC)	1 km
hydrophobic organic carbon	insoluble organic (OPAC)	1 km
sulfate	sulfate (OPAC)	1 km
sea salt	sea salt (OPAC)	0.5 km

Mistake: organic carbon was zeroed out (~10% of aerosol)

Tuned calculations: (Clear TOA SW) – (Pristine TOA SW)



(Observed CERES clear SW) – (Calculated pristine TOA SW)



CERES cloud screening captures more signal of biomass burning as “clear”

Clear-sky Aerosol Forcing April 1998 CERES TRMM 40N-40S

Raw average - no diurnal smoothing - TRMM precesses thru dirurnal cycle
April 1998 daytime coverage of NH and SH was balanced.

Aerosol Forcing Wm-2

SW Up at TOA	3.24
LW Up at TOA	-0.38
SW Heating of Atmosphere	2.27
LW Heating of Atmosphere	-0.58
SW Down at Surface	-6.25
LW Down at Surface	0.99
Ocean only	
SW Up at TOA	3.35
SW Up at TOA	3.41

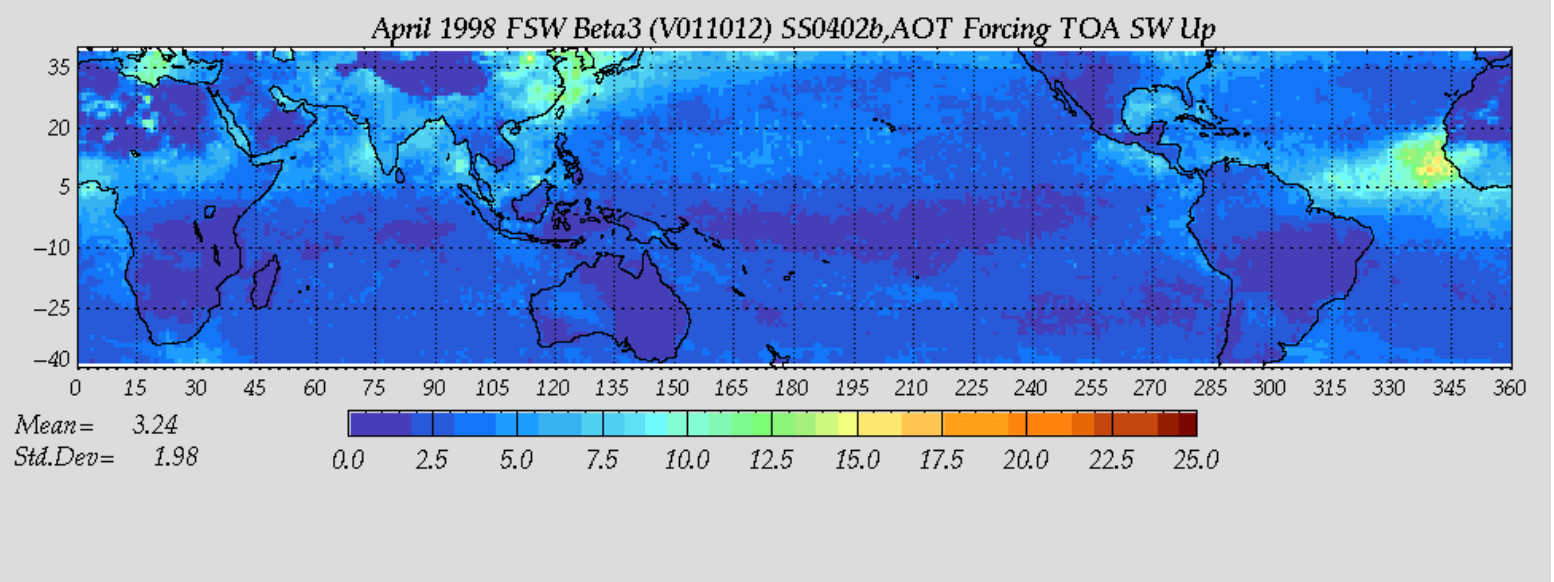
Comparable to Loeb & Kato, who interpolated clear observation for pristine flux.

Forcing = (Clear Observation) - (Pristine Calculation) → Okay for ocean SW TOA only

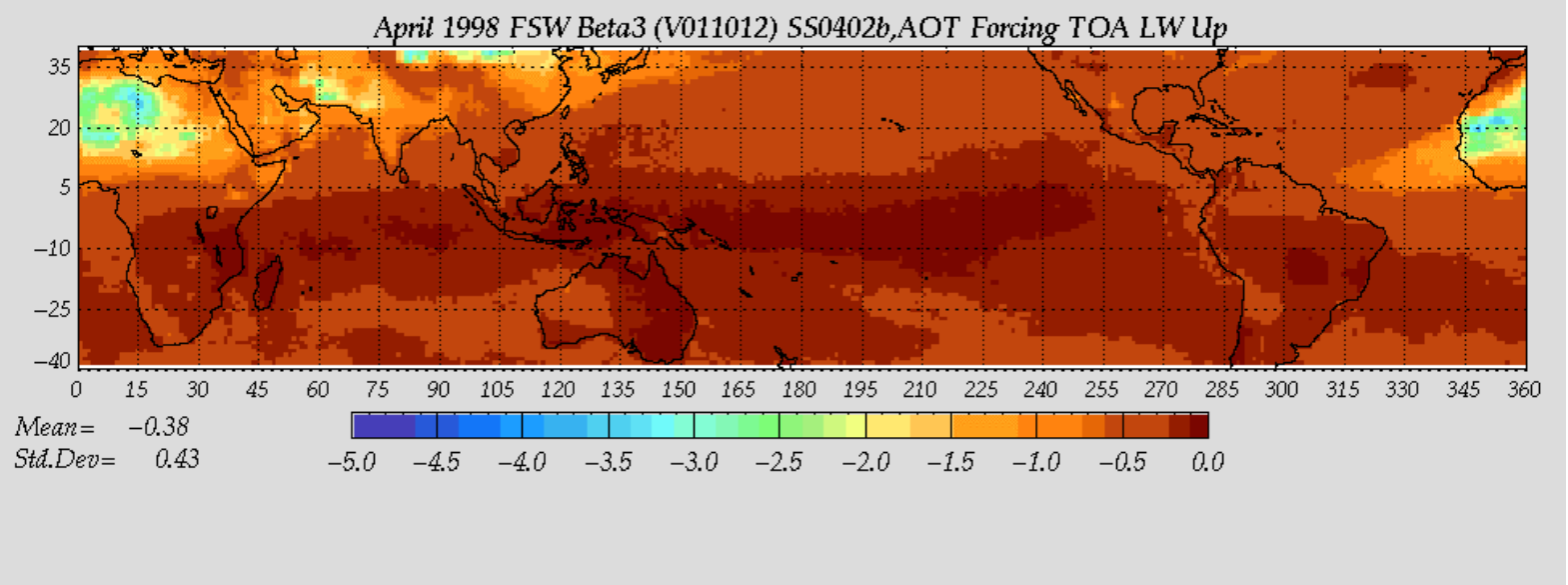
Forcing = (Clear Calculation) - (Pristine Calculation) → Okay for ocean/land/SW/LW/TOA/surface

Pristine: No aerosols

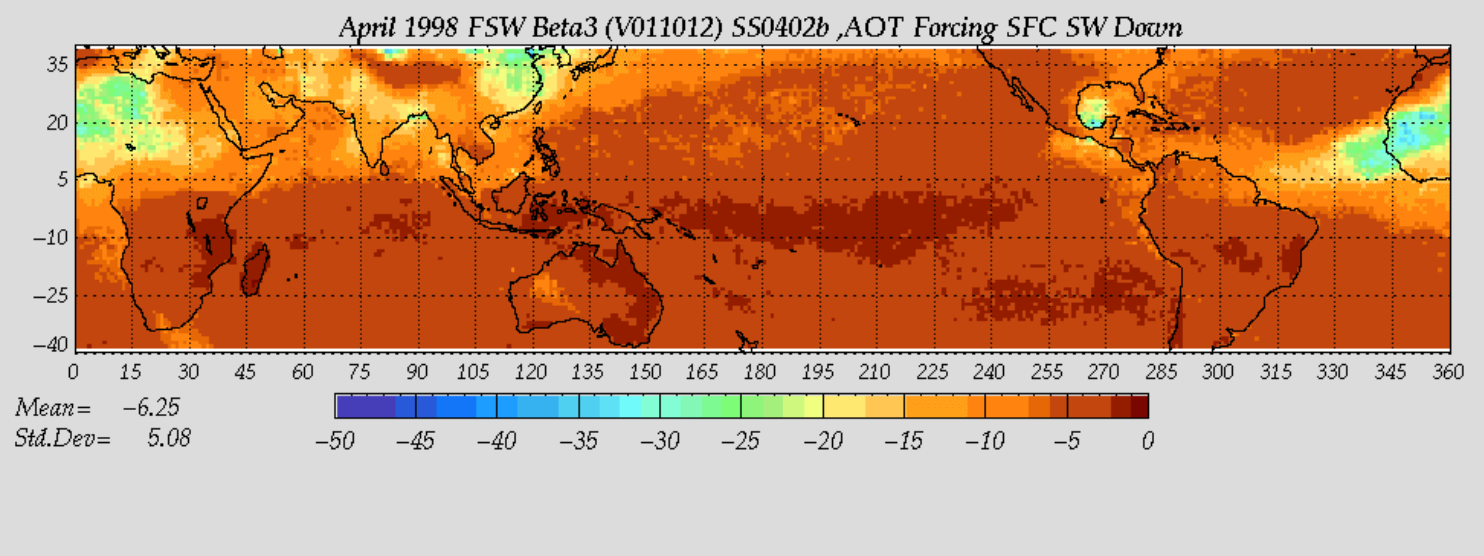
Aerosol Forcing to SW Up at TOA (clear)



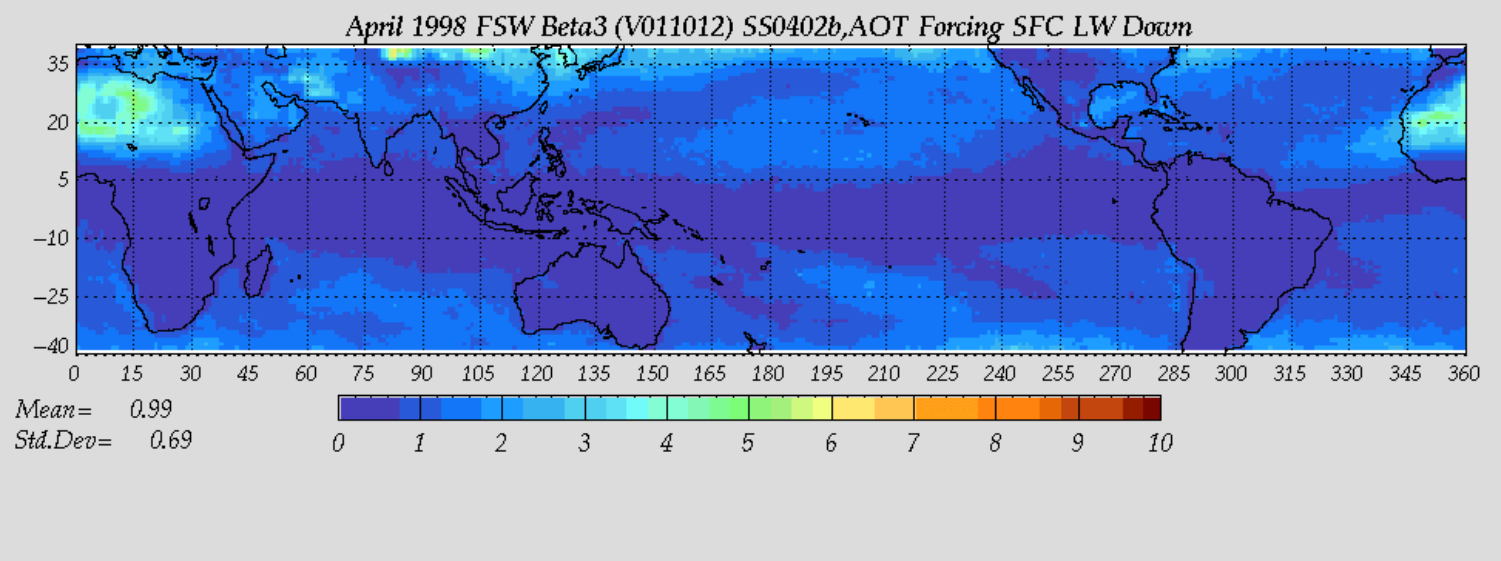
Aerosol Forcing to LW Up at TOA (clear)



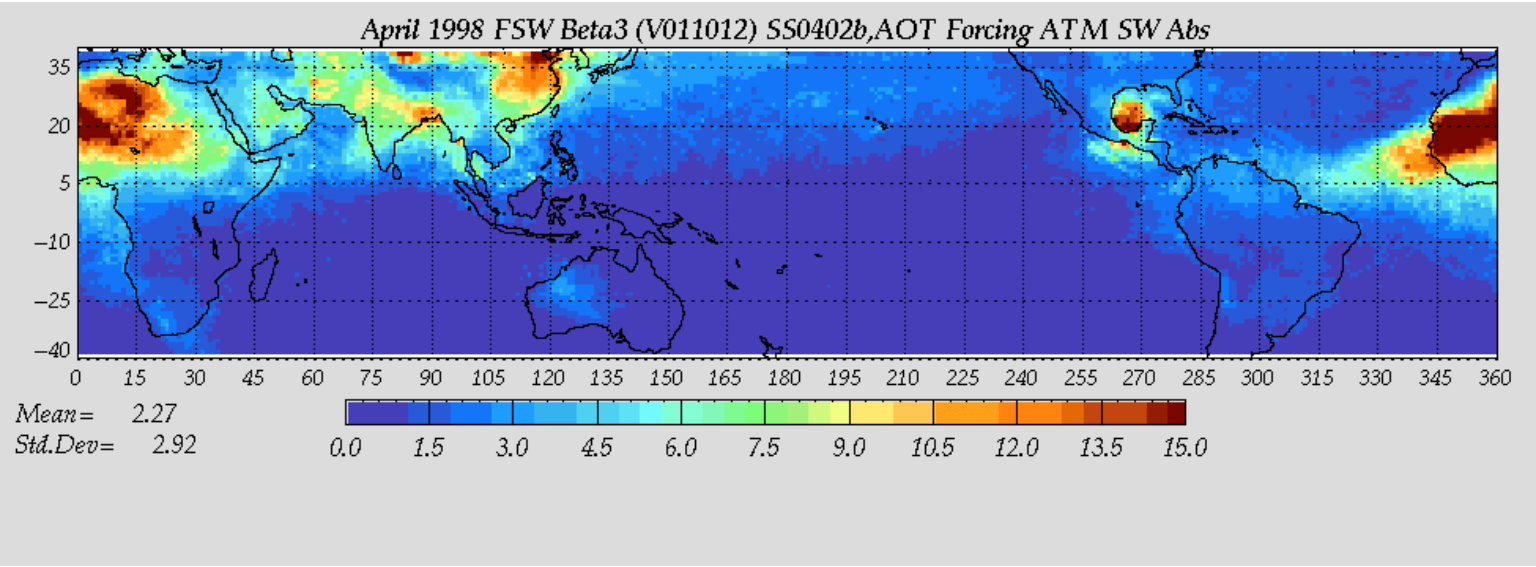
Aerosol Forcing to SW Down at Surface (clear)



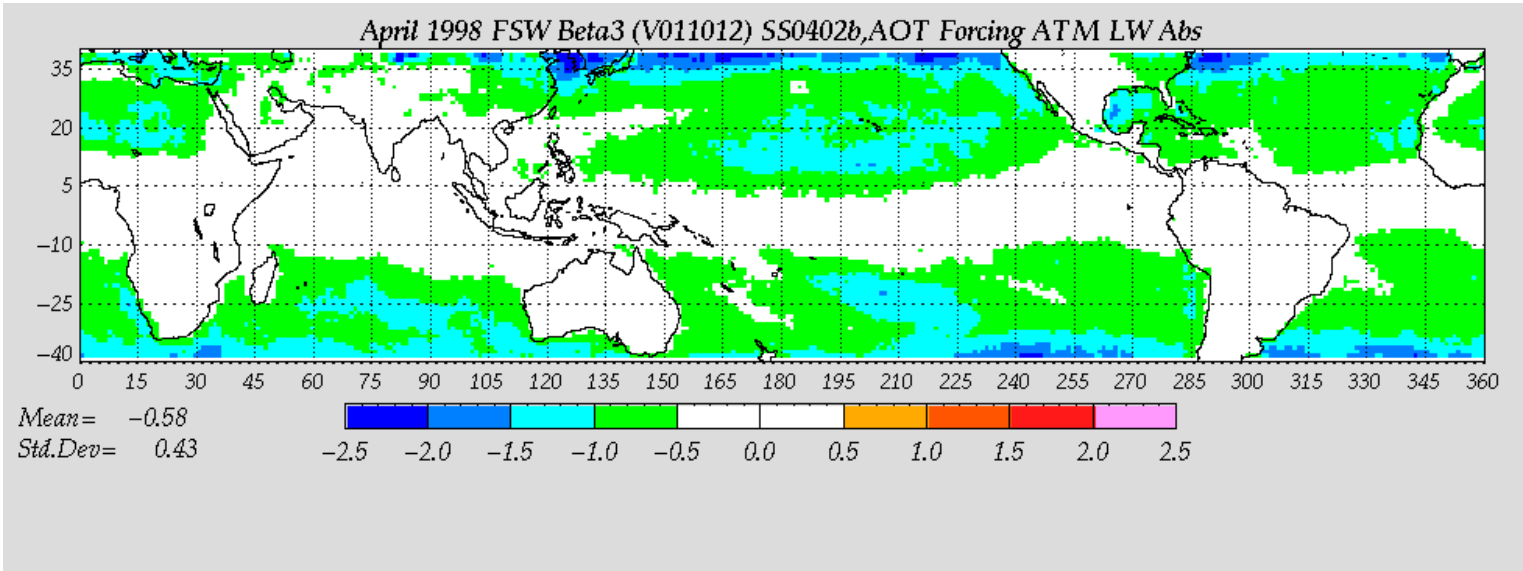
Aerosol Forcing to LW Down at Surface (clear)



Aerosol forcing to SW heating of atmosphere (clear)

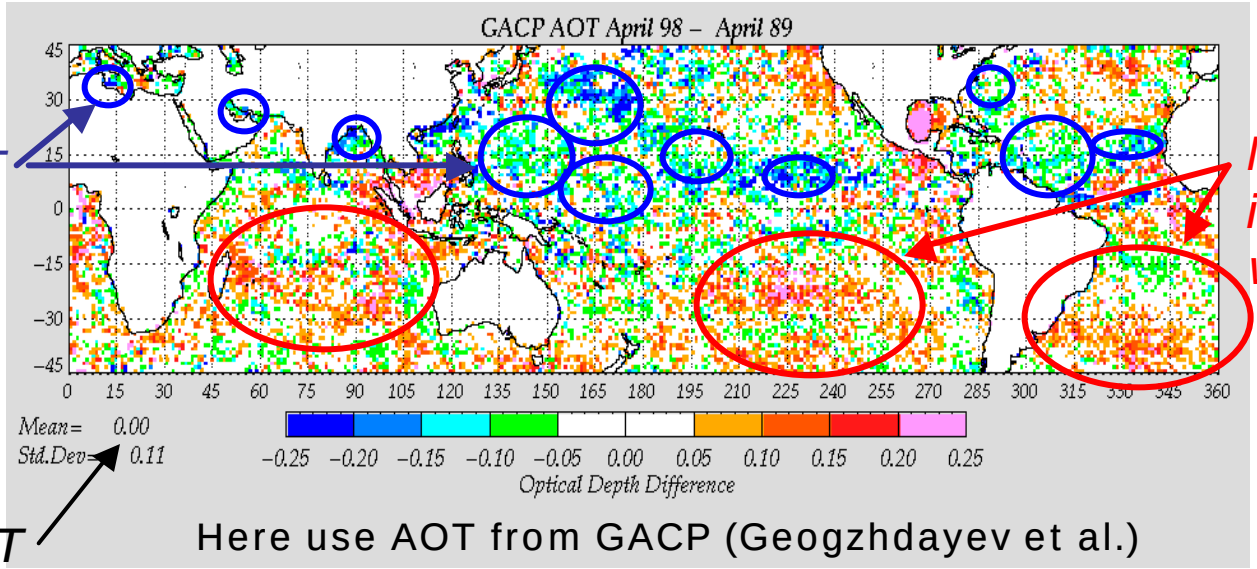


Aerosol forcing to LW heating of atmosphere (clear)



[AOT April 98] – [AOT April 89] as "ENSO minus non-ENSO" ?

Less AOT in NH with ENSO



More AOT in SH with ENSO

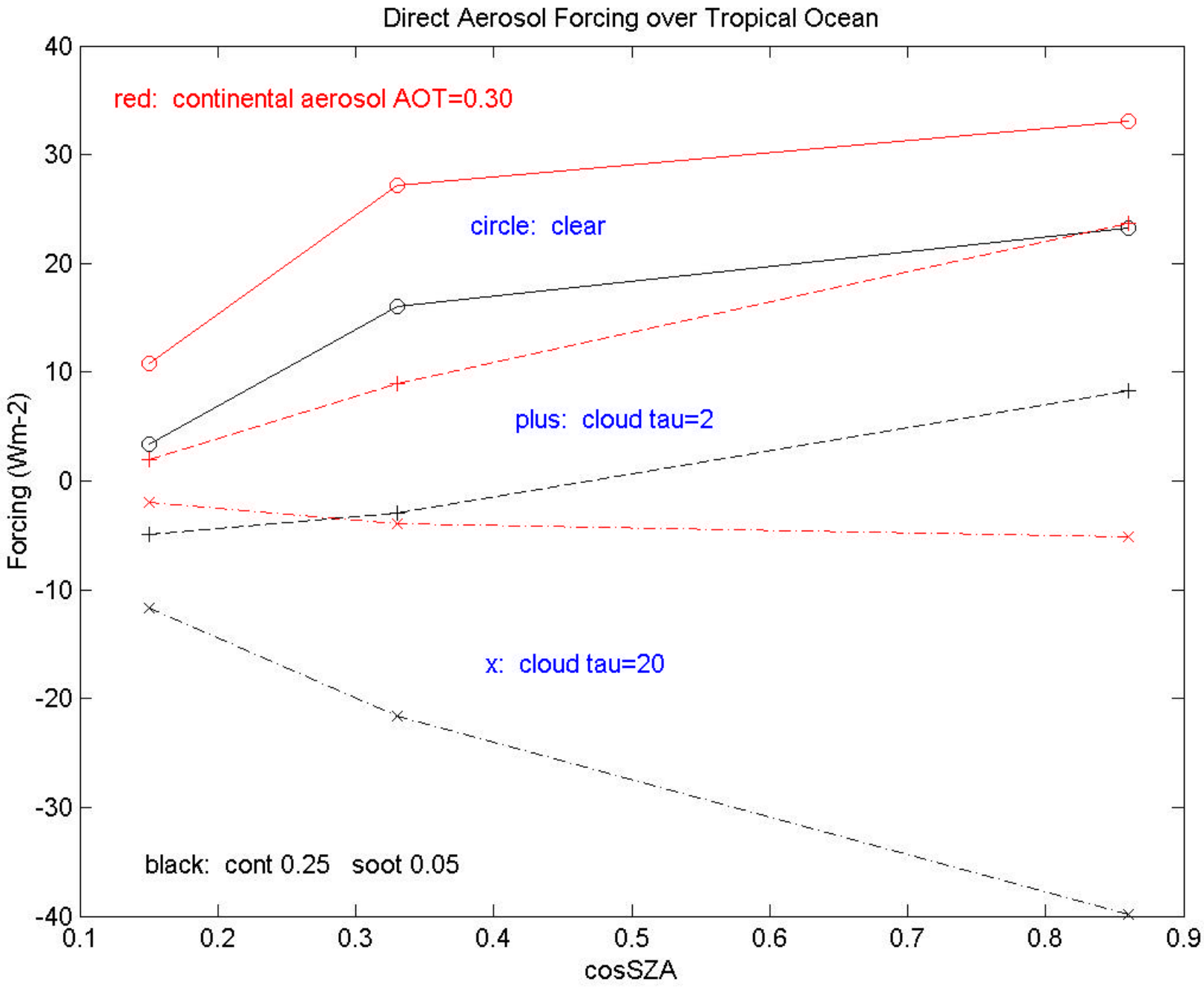
Mean AOT change = 0.00 with ENSO

Here use AOT from GACP (Geogzhdayev et al.)

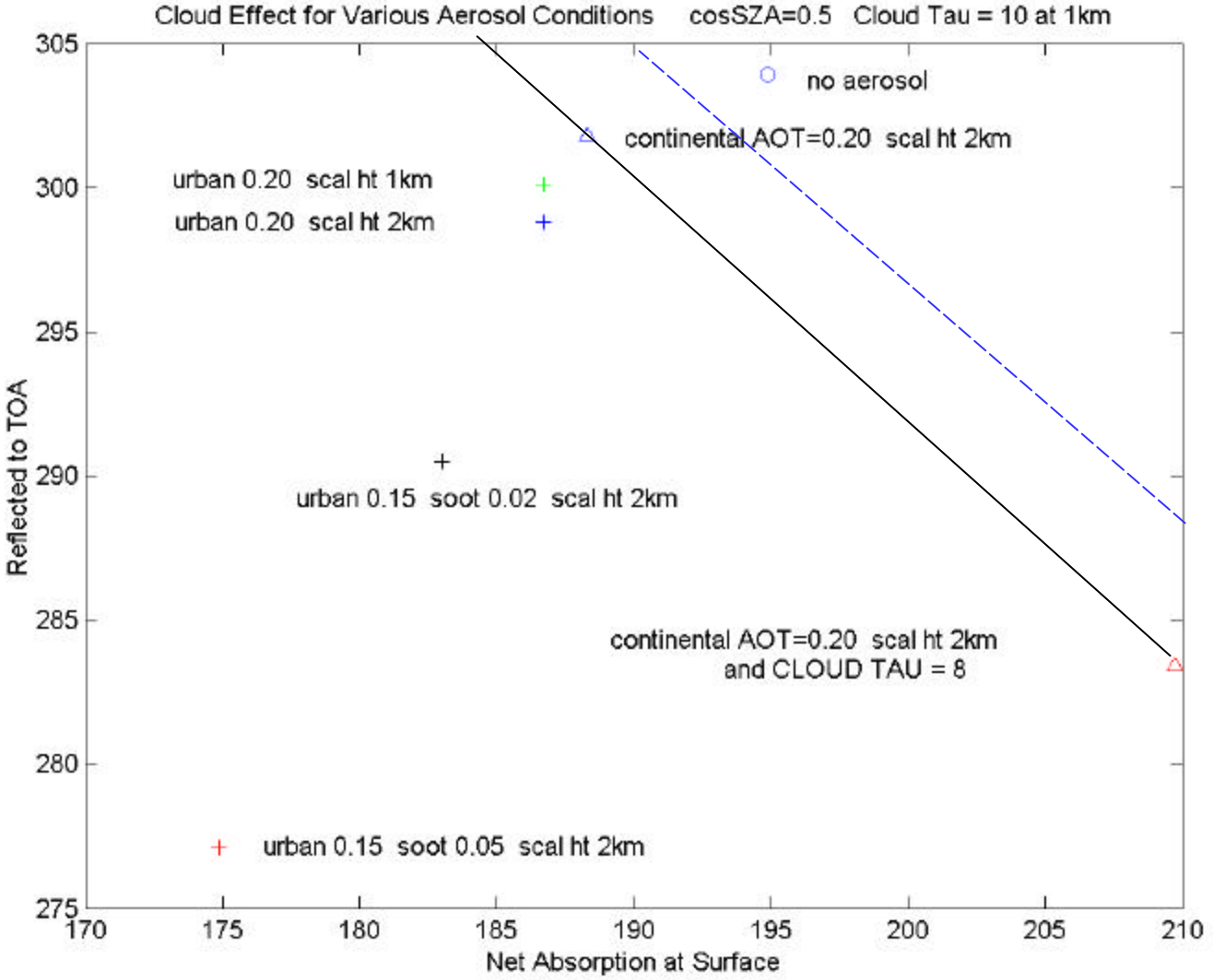
ENSO may decrease (increase) AOT in NH (SH) oceans.

Forcing to SW Heating of Atmosphere *map for April 1998 shows that most aerosol heating occurs in NH.*

We speculate that one impact of ENSO on April 1998 was a significant DECREASE in aerosol induced SW heating of the atmosphere over the NH oceans.


Direct Aerosol Forcing over Tropical Ocean
red: continental aerosol AOT=0.30
circle: clear
plus: cloud tau=2
x: cloud tau=20
black: cont 0.25 soot 0.05
Forcing (W/m-2)
cosSZA
40
30
20
10
0
-10
-20
-30
-40
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

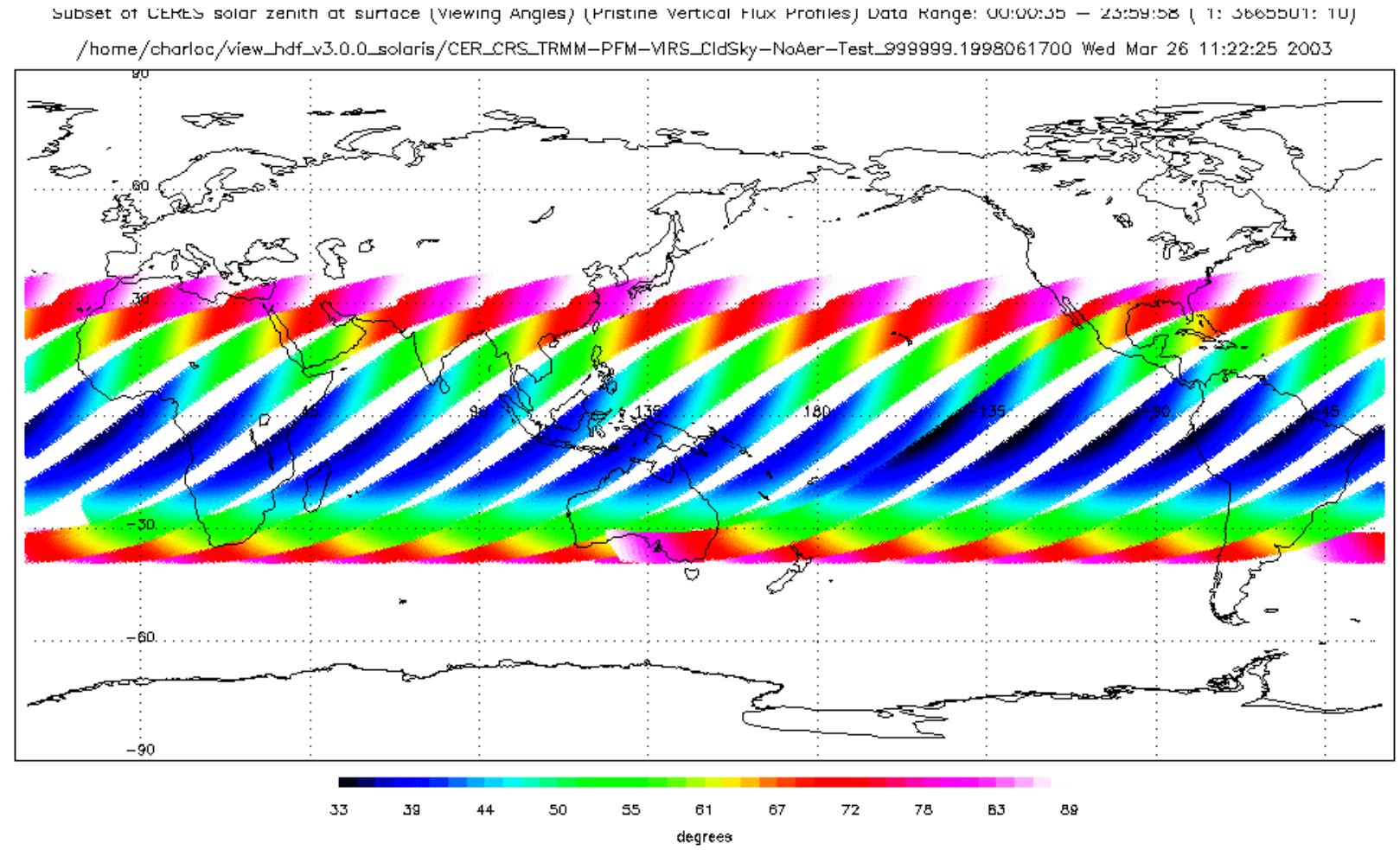
Assume the black line is true. If MATCH gives land AOT that's low, as we suspect, the line we use now would be to the right (dashed blue), and we'd overestimate insolation below low clouds.



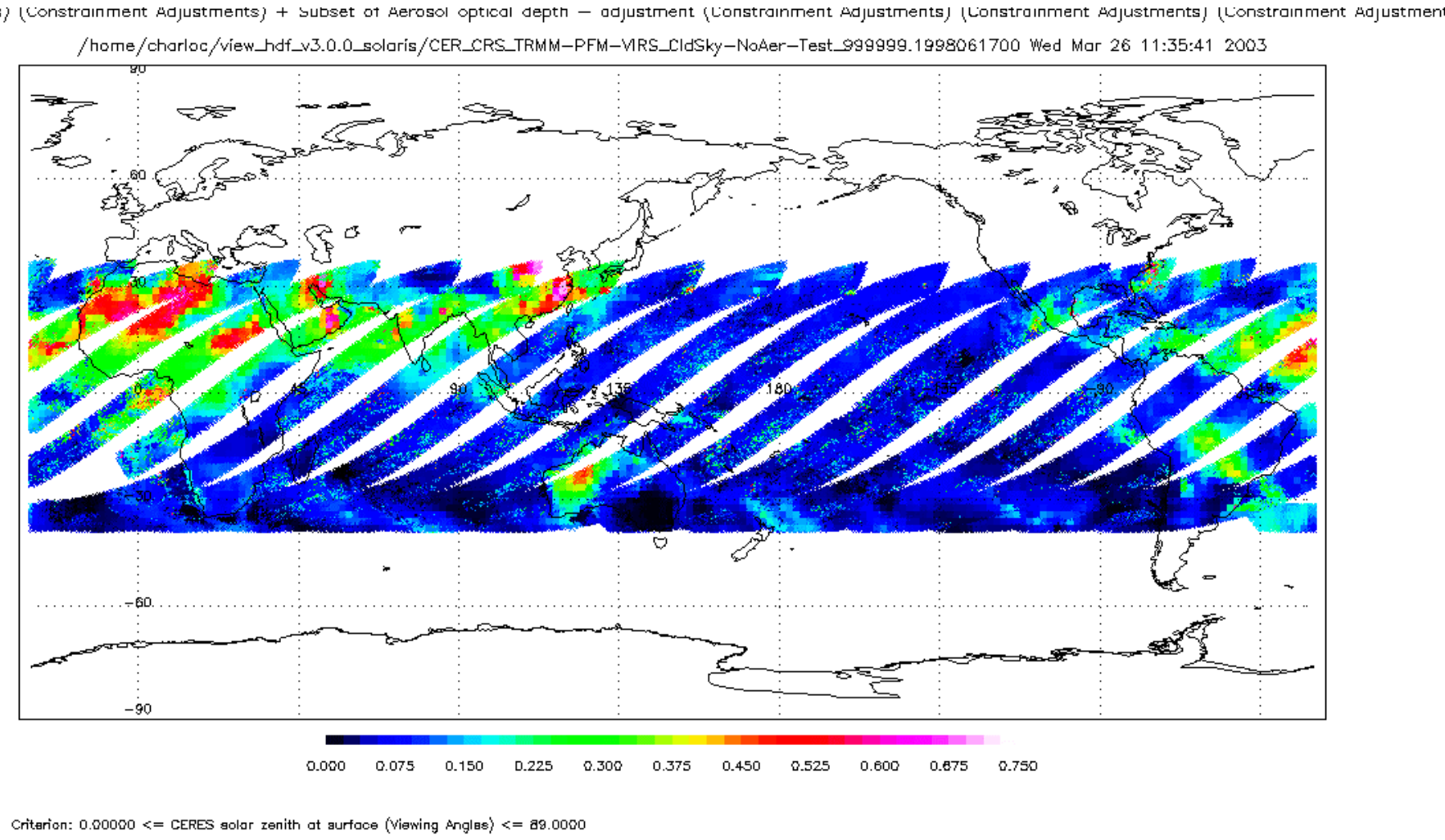
If we underestimate AOT or aerosol absorption, the arrival of low clouds is hardly our deliverance. We still get an error for insolation.

Lisa Coleman's test run on SCF (with Erika's view_hdf help)

TRMM CosSZA for 17 June 1998

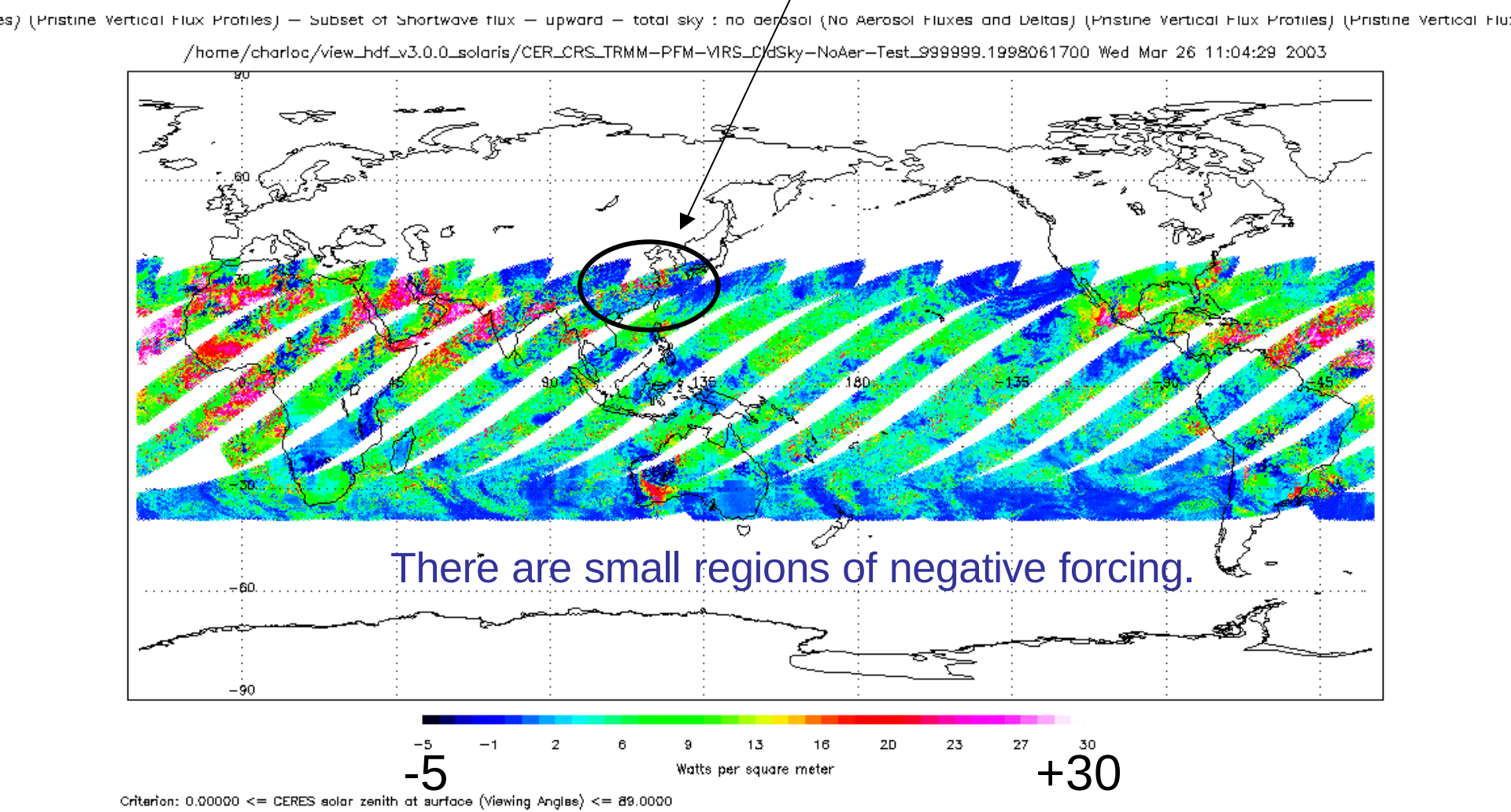


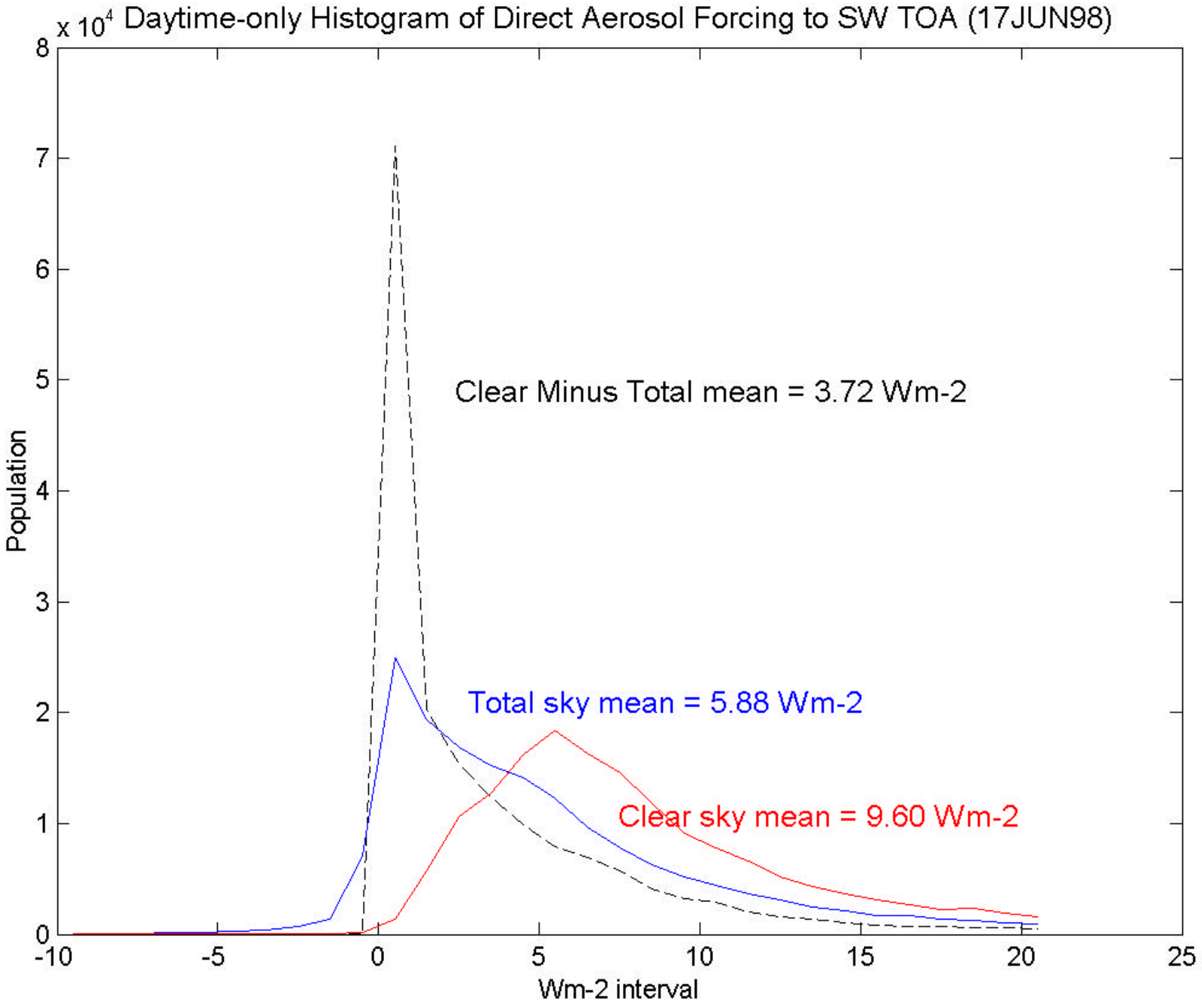
AOT Input for SARB (June 17, 1998)



Total-sky Direct Aerosol Forcing to SW at TOA (June 17, 1998)
Aerosol affects flux in both clear and cloudy footprints.

Clouds reduce aerosol forcing in this region of high AOT




x 10^4 Daytime-only Histogram of Direct Aerosol Forcing to SW TOA (17JUN98)
Population
Wm-2 interval
Clear Minus Total mean = 3.72 Wm-2
Total sky mean = 5.88 Wm-2
Clear sky mean = 9.60 Wm-2
0
1
2
3
4
5
6
7
8
-10
-5
0
5
10
15
20
25

Aerosol Forcing to SW at TOA: (Clear sky) – (Total sky)

Small values with big AOT:
region is clear

Large values with big AOT:
clouds hid the aerosols